DETAILED ACTION

Claim Status

Claims 11-20 are active in the case. Claims 1-10 have been cancelled by preliminary amendment. Claims 11-20 are under examination; no claims are withdrawn as non-elected.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adolf et al. (US 5,250,167) in view of Hirai et al. ((2003) Proc. of SPIE 5051: 198-206), Madden et al. (US 6,249,076), and Shahinpoor et al. (US 6,475,637). Adolf et al. teach a polymer actuator comprising: a plurality of gel/electrode complexes arranged in an electrolytic aqueous solution, said gel/electrode complex being composed of a polymer gel containing at least one of acidic and basic functional groups and electrodes placed in the polymer gel, said electrodes being made of a material capable of occluding and releasing hydrogen electrochemically, such that the polymer gel in the gel/electrode complex changes in pH upon application of voltage across the electrodes of the gel/electrode complexes and each of the gel/complexes changes in volume in response to the pH change (abstract, col. 1 lines 33-55). They teach that the complex may be arranged as a fiber (col. 3, lines 49-68) "as known in the art" and that the electrodes should project from the container (Fig. 4). They do not teach a palladium catalyst or a coil/mesh structure.

Hirai et al. teach the creation of a polymer gel/electrode actuator using a range of gels; they discuss the relative merits and bending capability (which will translate to force available for the actuator) of the different gel types. They teach electrodes on both sides of the gel container (Fig. 10). They discuss the addition of "dopants" such as amine and carboxyl groups to the gel to control the redox nature of the polymer (section 3.3.3). Madden et al. teach An actuator comprising: an electrolyte; a counter electrode coupled to the electrolyte; and an active member comprising a polymer, the active member having an axis, a length defined along the axis, and having a surface coupled to the electrolyte, the active member capable of exerting, essentially

along the axis, a force per unit area of at least 10 MPa concurrent with application of an electrical potential between the active member and the counter electrode (claim 1). They teach Palladium as one of the possibilities for an electrode (col. 6, lines 28-36). Shahinpoor et al. teach an actuating device comprising: an ion exchange polymer; a porous conductive layer embedded in said polymer with penetration inside said polymer comprising at least two embedded electrodes wherein application of an electrical potential across said electrodes causes movement of said polymer in a dry environment; and an impermeable flexible coating encapsulating said ion exchange polymer (claim 8), with the use of Palladium (col. 6, lines 25-40) and the use of a coil structure (col. 3, lines 19-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Adolf et al., Hirai et al., Madden et al., and Shahinpoor et al., along with many other prior art teachings as enumerated in each of these, to create a polymer actuator using a gel/electrode complex. Various configurations of gel, electrodes, chemical reactions, and structures would be known in the art to provide the most motive force with the most stability of the system. As Hirai et al. state "the concept proposed is simple and can be applied to a wide range of materials"; they assert that sample durability for these actuators "was excellent" (conclusions). One would have a reasonable expectation of success in creating a gel/electrode actuator using the various systems as described by the prior art since many variations were already known and information on the construction, use, force available, reliability, and durability of the various configurations was publicly available.

Response to Arguments

Applicant's arguments filed 07 July 2008 have been fully considered but they are not persuasive. Applicants argue that Fig. 1 of Adolf et al. discloses that an inert spacer (26) serves to keep fibers (24) ionically isolated from cathode end plate (16) and that the spacer (26) is necessary to the configuration of this system; that without the spacer there would be no net mechanical force in this example. Applicants argue that Adolf thus fails to teach the instant independent claim. Applicants arguments have been fully considered but are not persuasive for the following reasons: Adolf et al. teach that a range of structures and placements is possible for the electrodes and the polymer gel and the spacer of Fig. 1 is not present in all the disclosed or discussed embodiments. For example, Fig 2 shows the electrode plates (46 and 48) in direct contact with the gel filler (54, 56). While Fig. 1 disclosed an anionic gel, which could not be in contact with a cathode, Fig. 2 discloses a mix of gels in contact with both electrodes. "Aggregate 54 is made up of anion-rich polyelectrolyte polymeric gel 56 in the vicinity of anode end plate 48 and cation-rich polyelectrolyte polymeric gel 58 in the vicinity of cathode end plate 46. Gels 56 and 58 are joined at a point about midway between end plates 46 and 48 within cylindrical shell 42, respectively, by means of direct union or attachment through intermediate means such as a bulkhead" (col. 3); Fig. 5 teaches a similar arrangement, where electrodes (146, 148) are directly exposed to the gel (154, 156) within the system. As well, Fig. 3 teaches another arrangement of electrodes and gel, where the electrodes (79, 80) are dispersed within the walls and the gel (82). Fig 4 teaches another embodiment wherein the electrodes (104, 106) are exposed to the gel (114) at each circumference of the structure. Thus, Adolf et al. teach a range of gel and electrode dispositions, including each gel/electrode complex is arranged in an electrolytic solution; Adolf

et al. teach that each or either electrode may be arranged in the system in contact with gel and they teach that one of skill could use the described embodiments to create appropriate electrical connections to obtain motive force.

Applicants arguments with reference to the additional references not supplying the deficiencies of the Adolf et al. reference have also been carefully considered, but are also not persuasive. As in the action, applicants affirm that Hirai et al. teach dopants and Madden et al. teach palladium. Applicants then argue that Shahinpoor et al. teach a coil structure, but in a dry environment and that they teach away from the polymer gel complexes. However, they teach (col. 3) a prior Shahinpoor patent that discloses "electrically controllable polymeric gel actuators or synthetic muscles, using gels made of polyvinyl alcohol, polyacrylic acid, polyacrylonitrile, or polyacrylamide contained in an electrolytic solvent bath. These actuators operate by reacting to changes in the ionization of a surrounding electrolyte by expanding or contracting, and can be spring-loaded and/or mechanically biased for specific applications. Polymeric gel configurations such as sheets, solid shapes or fiber aggregates are contemplated, as are the use of a salt water solution for the electrolyte, and a platinum catalyst in the actuator housing to recombine the hydrogen and oxygen produced as a result of electrolysis during ionization of the electrolyte." The statements regarding the disadvantages of some polymer actuators is support for their instant invention of a type of polymer actuator that can perform increased and improved bending and displacement, as in biological muscles.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or

improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 11-20 are provisionally rejected on the ground of nonstatutory double patenting over claims 14-26 of copending Application No. 10/536934. This is a provisional double patenting rejection since the conflicting claims have not yet been patented.

The subject matter claimed in the instant application is fully disclosed in the referenced copending application and would be covered by any patent granted on that copending application since the referenced copending application and the instant application are claiming common subject matter, as follows: a polymer actuator comprising a plurality of gel/electrode complexes arranged in an electrolytic solution gel/electrode complex being composed of a polymer gel containing acidic or basic functional groups and electrodes placed in the polymer gel, such that the polymer actuator changes in volume upon application of a voltage across said electrodes. Furthermore, there is no apparent reason why applicant would be prevented from presenting claims corresponding to those of the instant application in the other copending application. See *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968). See also MPEP § 804.

Art of Record

The examiner notes the following prior art not relied upon in a rejection: Kurauchi et al. (JP40204168A). Kurauchi et al. teach a polymer gel electrode complex where voltage can be applied between the electrodes changing the volume of the gel, the solution is "swelled", to create a mechanochemical actuator.

Conclusion

No claims are allowed.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lisa J. Hobbs whose telephone number is 571-272-3373. The examiner can normally be reached on Monday to Friday, 8:00 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jon P. Weber can be reached on 571-272-0925. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lisa J. Hobbs/
Primary Examiner
Art Unit 1657

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